ASSESSMENT OF TOPOGRAPHIC VARIATION IN UMP GAMBANG CAMPUS USING LAND SURVEY APPROACH

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ABSTRAK

Universiti Malaysia Pahang (UMP) merupakan pusat pendidikan tinggi yang mengfokuskan jurusan kejuruteraan. UMP mempunyai banyak banggunan berbentuk ikonik yang dapat dilihat setelah sahaja masuk ke dalam kawasan UMP. Struktur tanah yang dapat dilihat adalah banyak kawasan rata tetapi mempunyai ketinggian yang berbeza. Objektif kajian ini adalah untuk menentukan ketinggian rupa bumi topografi di UMP Kampus Gambang dan untuk meyediakan pemetaan topografi semasa dengan lebih tepat. Keadaan topografik yang terdapat di sana perlu diteliti kerana Universiti Malaysia Pahang (UMP) giat menjalankan program bertunjangkan kepada Matlamat Pembangunan Lestari (SDG) yang menjadi agenda global seiring dengan 17 matlamat yang perlu dicapai seperti yang diperkenalkan Pertubuhan Bangsa-Bangsa Bersatu (PBB) untuk semua negara menjelang 2030.

ABSTRACT

The higher education institution Universiti Malaysia Pahang (UMP) concentrates on engineering studies. As soon as you enter the UMP region, you will see several icon-shaped buildings. Numerous flat sections of varying heights make up the land structure that is readily seen. The objectives of this study are to determine the elevation of the topography variant's terrain relief at UMP Gambang Campus and to provide the current topography mapping accurately. Because Universiti Malaysia Pahang (UMP) is actively implementing programs in support of the Sustainable Development Goals (SDG), which have become a global agenda in accordance with the 17 goals that must be accomplished by all countries by 2030, the topographic conditions observed there need to be explored.

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Landforms, elevation, latitude, and longitude are four primary topographical characteristics. The term "landform" refers to geographical formations that have an influence on a region, such as valleys, mountains, lakes, rivers, dams, towns, and hills. The height of mountains and other objects in relation to sea level is recorded using elevation, on the other hand. Contour lines on a topographical map show the elevation. The height of all points touching contour lines should be the same. The contour lines indicate different altitudes when they are near to one another. The slope of the terrain increases as the contour lines get closer to one another. The latitude of a region is its north or south location with respect to the equator, which lies in the centre of the planet and, as a result, has a longitude of zero degrees. In contrast, longitude refers to a location's east or west position in relation to the Prime Meridian. This position is measured in degrees.

Figure 1.1 Elevation map of Malaysia from JUPEM published in 2014

1.2 Problem Statement

The UMP Gambang Campus should be shown on a current topographical map accurately. Therefore, this research will aid in various areas of UMP Gambang Campus, including making development planning easier. UMP Gambang Campus is next to the main road to Gambang, Kuantan and Pekan, encouraging many visitors to stop in the vicinity of the UMP area. Therefore, this area is seen as strategic for future development. Environmental areas that have the potential to be developed as industrial and residential areas must first conduct a land structure study before any development work is started. The development of construction in the surrounding area has a great effect on the topography plan. The uncontrolled illegal human activities such as tree felling activities also can be affecting on land structures.

Other than that, the precipitation also can give the big impact to the elevation of land topography. The water flow from high elevation brings the sand to the low elevation of land can affect the current topography mapping. This effect does not occur quickly but slightly slowly over time. Large rocks and soil from neighbouring mountainous areas can be eroded by water, changing the landscape as they loosen the earth's surface. Wind and water are the main factors. This process might be extremely slow, lasting millions of years, or it can be hastened by human activity like mining or agriculture.

However, in Malaysia, the studies and application of land survey are more to technology surveying method that easier to use. Surveyors are increasingly using modern techniques to study large areas like districts, forests, and mountainous regions. The main purpose of using technology is the same as the land survey method, which is to study the elevation of the area. However, this method is not accurate when compared to the land survey method. Therefore, surveyors use this method in construction building to take the accurate data of elevation. This precision is very important in construction works to ensure the balance and strength of the building over a long period of time. Therefore, the surveyor is responsible in the initial phase of the construction process. The land survey method is limited to small area project and conducted by construction company only.

1.3 Objectives

This study is mainly focused on two aspects of topography variation:

i. To determine the elevation of the topography variant's terrain relief at UMP Gambang Campus.

ii. To provide the current topography mapping accurately.

1.4 Scope of Study

This scope of the study has been determined was focused on UMP Gambang Campus areas that has a lot of topography variation. The data was collected cover all areas of UMP Gambang Campus include faculty area, counsellor building, library, mosque, students resident, UMP sport complex and parking lot. Figure 1.2 shows the location of the study area with a propose station site.

Figure 1.2 Mapping of study area in UMP Campus Gambang

This area provided an elevation that interesting to study. The study carried out the data elevation of topography variation limited to the land survey approach only. The data will show us the elevation of land within the study area. The data was entered into Google Earth Pro software to display the cross-section of elevation in UMP Gambang Campus.

1.5 Significant of Study

The study proposes the accurate method to provide the detail elevation mapping in UMP Gambang Campus. Therefore, the findings can show us how many litters UMP can accommodate if the flood happen. The topography results are mostly used by the weather office to make predictions. Weather experts can better predict wind gusts, storms, and other weather-related events because to topography. Therefore, the developer can prepare to installing the economical drainage systems. The research also can help the developer to plan to improve the facilities area nearby. Moreover, determine the low-risk area for intact area of interaction between human and land slope. The developer can easily know the suitable and strategic area to make the new facilities to students or and workers. Furthermore, the output offers the basic of method to determine the elevation using land survey approach.

The study of topographic is significant because it enables individuals in a variety of professions to comprehend the state of the land and take written action. At small geographic scales, land surveys are very useful for contouring topography and relief maps. The alignment of roads, trains, canals, tunnels, electric, sewage, and water lines, as well as bridges, is determined through surveying. The precise gradient for water lines, sewers, and roadways may be found directly by surveying. Therefore, surveyors need to analysis the drawing from developer. Drawing an irregular plot boundary on a map is a result of surveying. This data was very important for developer to determine the price and area of land to sell it to clients. Through a mining survey, surveying is done to estimate the amount of mineral content in the earth's crust.

Finally, this study contributes to SDG 11: Sustainable Cities and Communities, which aims to create inclusive, secure, resilient, and sustainable cities and human settlements. The strategy would make sure that the university's infrastructure is high-quality, dependable, sustainable, and resilient. As well to guarantee the harmony of campus life and environmental health. Additionally, this research will assist the university in determining which areas of the campus are ideal for the construction of new buildings, enabling them to create facilities that are more ecologically friendly.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In chapter 2 will lay out the topic of the techniques of land surveying. This subtopic explains the techniques that engineer do to take a survey data from land survey. Other than that, in this chapter also contain studies about Geographic Information System (GIS) one of surveying development. GIS technique is the less amount of energy needed to get the data at site. This is because the engineer just needs to search on google or download from specific engineering software to get the data without go to site survey. This chapter also describe Digital Elevation Models (DEM) help diversify topographic survey data. This technique is taking the picture of the topographic of the earth surface. They just need to combine the picture to take the data.

2.2 Techniques of Land Survey

Surveying is the process of obtaining detailed measurements scientifically. Surveying is the fundamental step in almost any civil engineering project. We obviously seen these people working on the side with a tripod, looking through some sophisticated surveying equipment. This will define the borders between property units correctly. In addition, surveying is done to locate existing infrastructure and map the terrain and elevations of the site. Large-scale construction has always been a learned behaviour by human. This implies a career in surveying is one that has a long history and always sees improvement from time to time. The purpose of the surveying is to present mathematical principles of surveying, emphasise the core ideas of surveying, and educate engineers with the theoretical foundations of optical equipment. Principles of surveying, linear measurements, chain surveying, levelling and its use in contouring, profiles, and cross-sections are the key topics covered in surveying (Mohammad Ali Khasawneh, 2016).

Land survey is one of the techniques that surveyors do on site before the construction project starts. This technique is the effective method to verify the topographic variation because surveyor can know a rough characteristic of the site using human senses. A detailed analysis of topographic variation is important because it has significant effects on ecosystems at all scales, from local to global, and it may have an impact on their ability to provide valuable ecosystem services such as food production, water resources, and climate stability (Foley, 2005; Pengra, 2012). Thus, mapping and tracking land cover and land cover change provides important data for a variety of societal and scientific goals. (Bontemps, 2011; Mueller and Seffrin, 2006).

Even though there are many land survey techniques that may be applied in the contexts we described above, land surveyors most frequently use five main techniques:

- triangulation
- trilateration
- traverse
- levelling
- radiation

2.2.1 Triangulation

A series of connected triangles that intersect and link each other are used in the triangulation land survey technique, and it is possible to estimate angles from specific stations from those angles. Given that it reduces the number of measurements that must be taken, this is the most popular and most efficient land surveying technique.

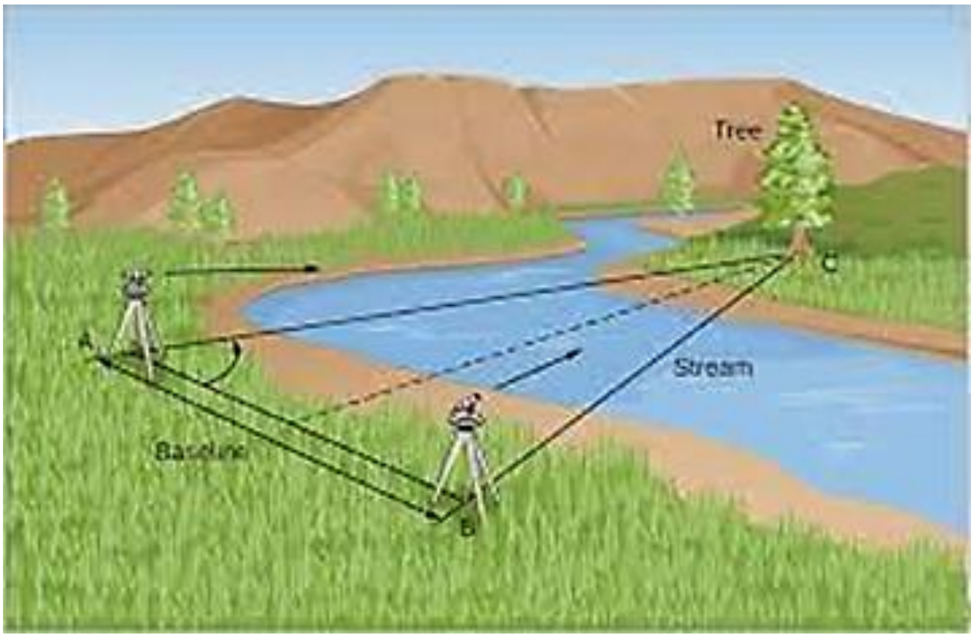

Figure 2.1 Illustration of Triangulation method

Source: (CharlotteWebb, 2021)

2.2.2 Trilateration

In the land surveying technique known as trilateration, the lengths and sides of the triangles that are used are measured, and the angles can then be calculated from those data. Trilateration is used over the more traditional triangulation land survey approach in challenging terrain because it can be easier to acquire accurate calculations.

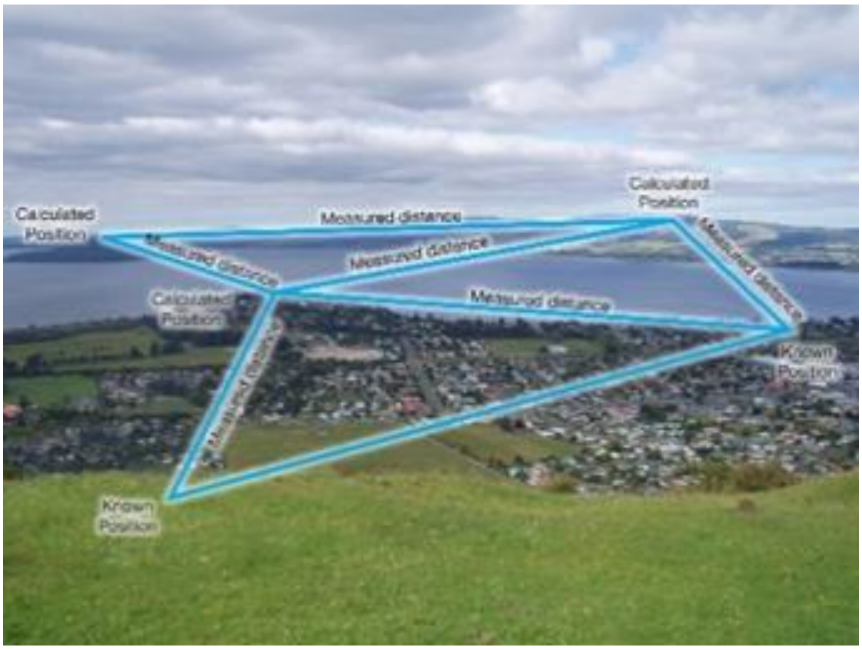

Figure 2.2 Mapping by Trilateration technique

Source: (CharlotteWebb, 2021)

2.2.3 Traverse

A network of lines with known lengths and distances that are joined by points placed at selected sites covers up the traverse land survey technique. Traverse lines can be either open or closed, and they can be changed as needed to travel around obstacles or difficult terrain. Preliminary surveys for the construction of new highways frequently employ this land survey approach.

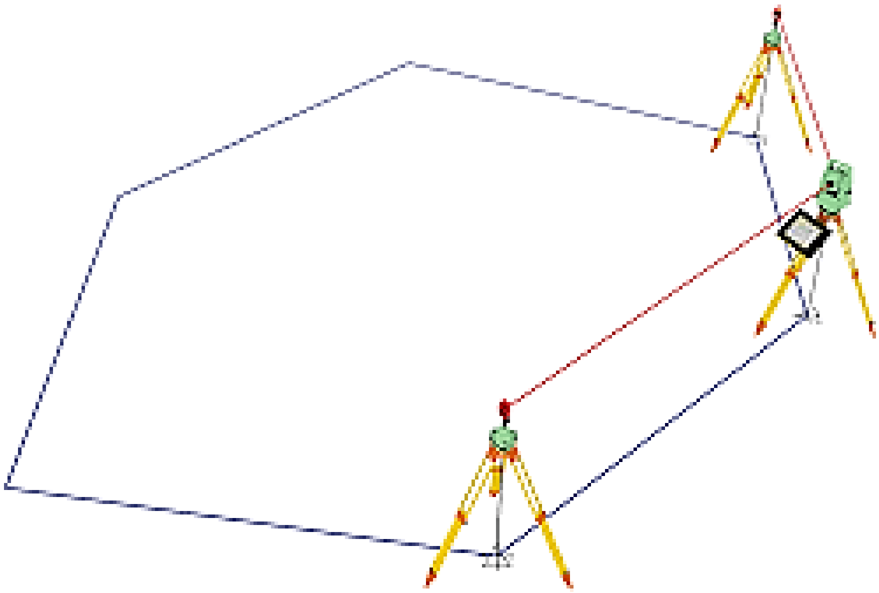

Figure 2.1.3 Illustration of Traverse Techniques

Source: (CharlotteWebb, 2021)

2.2.4 Traverse

By measuring vertical distances on a graded rod with the use of a levelling instrument, the land surveying technique known as levelling may be used to calculate the difference in elevation in each region. There are several levelling tools available, but dumpy levels, transits, and Theodolites are the recommended choices. Trigonometry can be used to calculate the elevation difference between two places.

Figure 2.3 Levelling techniques by using auto level and staff reading

Source: (CharlotteWebb, 2021)

2.2.5 Radiation

The last approach for land surveying is radiation. The land surveying method known as radiation is most usually used with a plane table. Several points are obtained from a fixed position above a ground location along the perimeter of the survey area. These points are sketched on a piece of paper once the distances between them have been measured, translated to the appropriate scale, and recorded on the survey sheet. Radiation is widely employed in land surveying together with other techniques like traverse and triangulation.

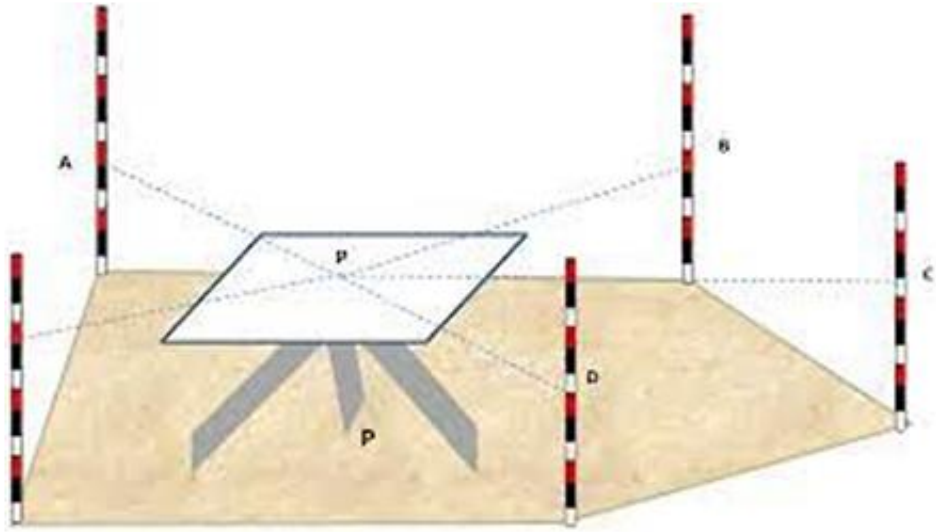

Figure 2.4 Radiation technique in land survey

Source: (CharlotteWebb, 2021)

2.3 Advantages of Using Land Survey

Before the frequently rapid development of technology, survey engineers used a fundamental technique called land survey. Although there are more advanced methods available today that offer many benefits for survey work, the land survey method cannot be abandoned because it has advantages of its own that are not offered by other different methodologies. Three categories can be used to group the benefits of land surveys which is effectively, workers, and cost.

For effectively categories, Land survey is the most accuracy method because this method is on fieldwork or site. The instrument of land survey can display more data with high accuracy and the station can be mark easily. There are instruments that we use in land survey method which is theodolite, auto level, reflector, tape, staff reading etc. This instrument was builds with less error by factory.

Other than that, this method uses less workers. This is because, they just need only 3 or 4 members only to setup the land survey instrument and take the reading. However, the most critical land structure, more workers need to setup. The procedure in this method just need to repeat in every station and less skill needed to collect the data.

Figure 2.5 Critical land structure

Source: (CharlotteWebb, 2021)

Lastly, the advantages for land survey method are less cost. The surveyor just needs to buy the instrument of land survey to collect the data and the instrument can be use many times in other surveying project. Other than that, the maintenance for the instrument is less because the factory had set the instrument with expensive item that have higher accuracy compare to drone that must to have more effort to make the maintenances.

2.4 Geographic Information System (GIS) Technology in Land Surveying Application

The Geographic Information System (GIS) framework enables the collection, archiving, management, and analysis of spatial and geographical data. Leading GIS service provider Polosoft Technologies offers specialised GIS services to its clients globally for mapping and interpreting geographical data. Polosoft Technologies is based in the UK and the US. Solutions created by Polosoft Technologies for better navigational purposes store, analyse, and display geographic data.

Maps and visualisations created using GIS are helpful for understanding conditions and showing elevation. They are a new technique that enhances interaction among many groups, divisions, disciplines, professional domains, organisations, and the general public.

The most common and well-known tool for mapping and spatial distribution analysis is called a Geographic Information System (GIS). It is employed by numerous researchers for a range of objectives. Indications from numerous periodicals and oblique passages from the literature demonstrate this understanding. Numerous studies have improved the literature because of how many tools, dependable, and adaptable this programme provides. (Raillani, 2022).

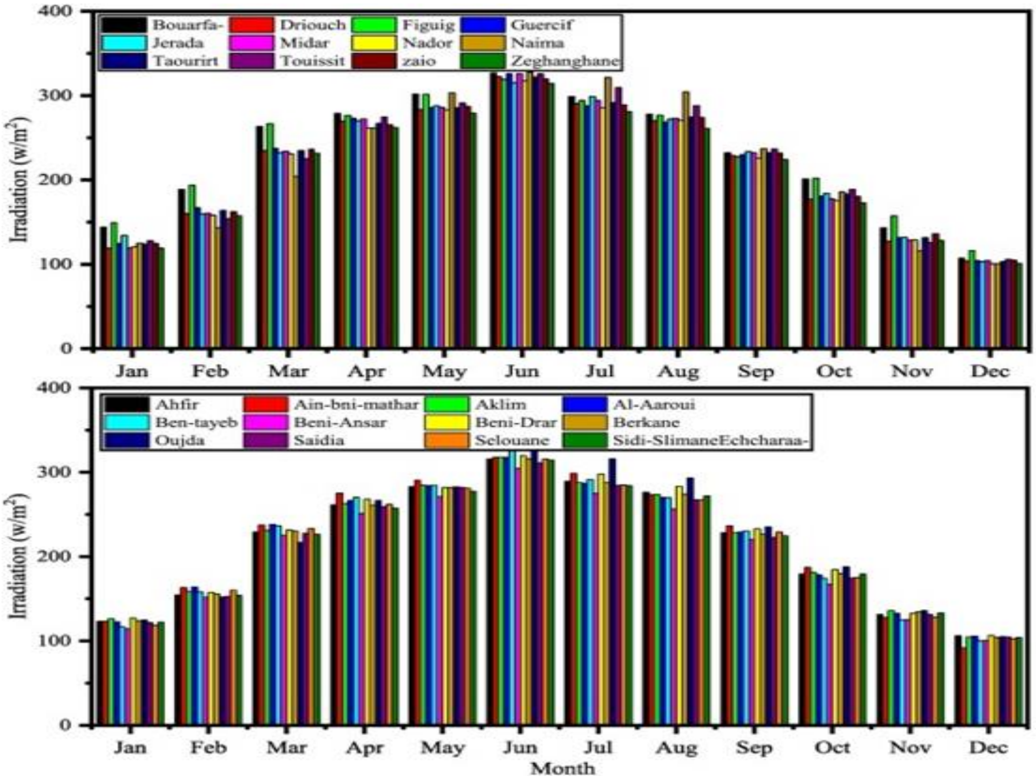

Figure 2.6 Global solar radiation was given by CAMs for the 24 chosen sites

Source: (Laguarda, 2020)

2.5 Digital Elevation Models (DEM) for Topographic Survey

A Digital Elevation Model (DEM) is a picture of the topographic surface of the Earth's naked ground (bare earth), free of any trees, structures, or other surface items. DEM are essential products of remote sensing and photogrammetry (Schindler et al., 2011), and they form one of the primary layers of topographic databases at the national, regional, and continental levels that make up the spatial data infrastructure (SDI). An increasing number of people are interested in modelling the interactions between different earth dynamic systems, such as atmospheric, geologic, geomorphic, hydrologic, and biological processes, through the quantitative characterization of land surface topography (Wilson, 2018).

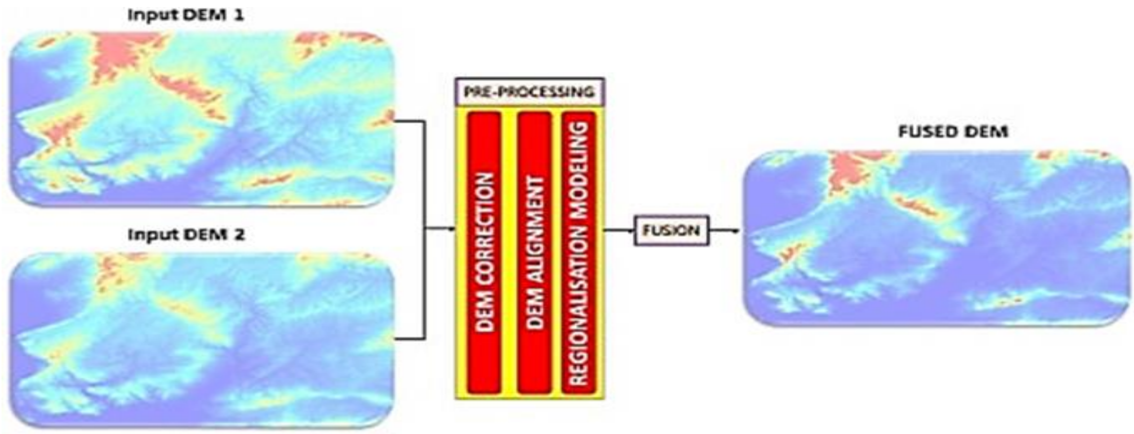

Figure 2.7 Graphical abstract

Source: (Okolie and Smit, 2022)

The surveying and mapping industries have continuously benefited from new technology that provide more accurate measurement or time and money savings. Because of this, over the last several decades the process for collecting topographic data has seen the mapping industry switch from traditional ground survey methods to passive and active sensing methodologies. (Okolie & Smit, 2022).

DEM can show us the variation of elevation easily but they cannot give the accuracy at the certain part of the earth ground for example in a cave or in the human construction. The data given on DEM always change from time to time. So, we must to study and take data continuously to make sure the accuracy is maximum. Other than that, the cost to build up the software is too expensive compare to others method of survey such as drone technology and land survey. The maintenance also needs to including. The engineer will do checking data using land survey to make sure the data is accurate with reality.

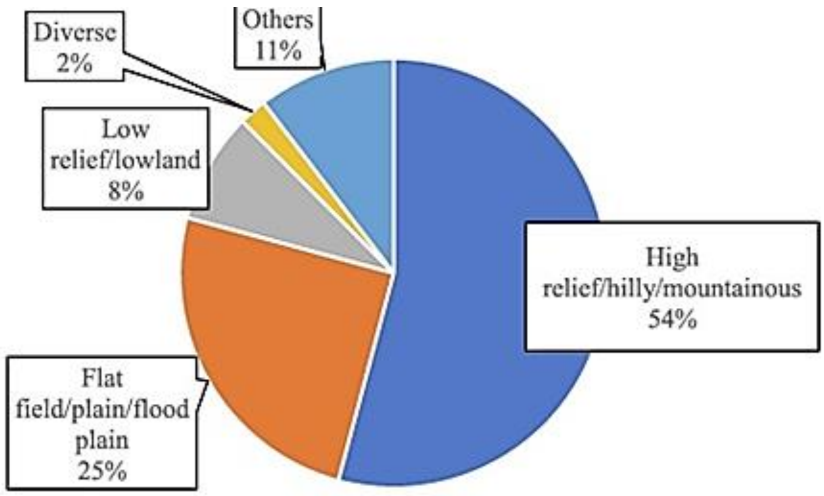

Figure 2.8 Percentage distribution of the most common terrain classes at study sites covered by DEM fusion studies.

Source: (Okolie and Smit, 2022)

Digital elevation models may be created in a variety of methods by specialists, although they often focus on remote sensing data rather than data from physical surveys. Interpolating digital contour maps that may have been created by actual surveying of the ground surface is a common step in the generation of DEMs using older techniques. In mountainous places, where interferometry is occasionally insufficient, this technology is still utilised. It should be noted that while contour line data and other sampled elevation datasets from GPS or ground surveys are not DEMs, they may be regarded as such. A DEM suggests that elevation is continually accessible at every place within the research region.

There are two types of DEMs with is Digital Terrain Models (DTMs) and Digital Surface Models (DSMs). Due to the DTM's exclusive inclusion of x, y, and z values for the ground, it is sometimes referred to as a bare-earth or ground-only elevation model. Digitally removing vegetation and building elements from the DTM data collection. However, the DSM includes all elevations, whether they come from the earth, vegetation, or man-made buildings. In engineering, building, and hydrographic applications where the topography of the natural terrain is crucial, DTMs are typically employed. On the other hand, DSMs are used in applications such as 3D visualization, infrastructure management, line-of-sight, and obstacle mapping where success depends on knowing the height of each landmark, whether man-made or natural.

CHAPTER 3

METHODOLOGY

3.1 Introduction

The method for the data collection used in this study is explained in detailed which focus to land survey approach using levelling method. This chapter also provide software methodology to process the data obtain from fieldwork to fulfilling the objectives of this study. The accuracy must to be check using formulas that provide in this chapter to ensure the data relevant to process.

3.2 General Flow Chart

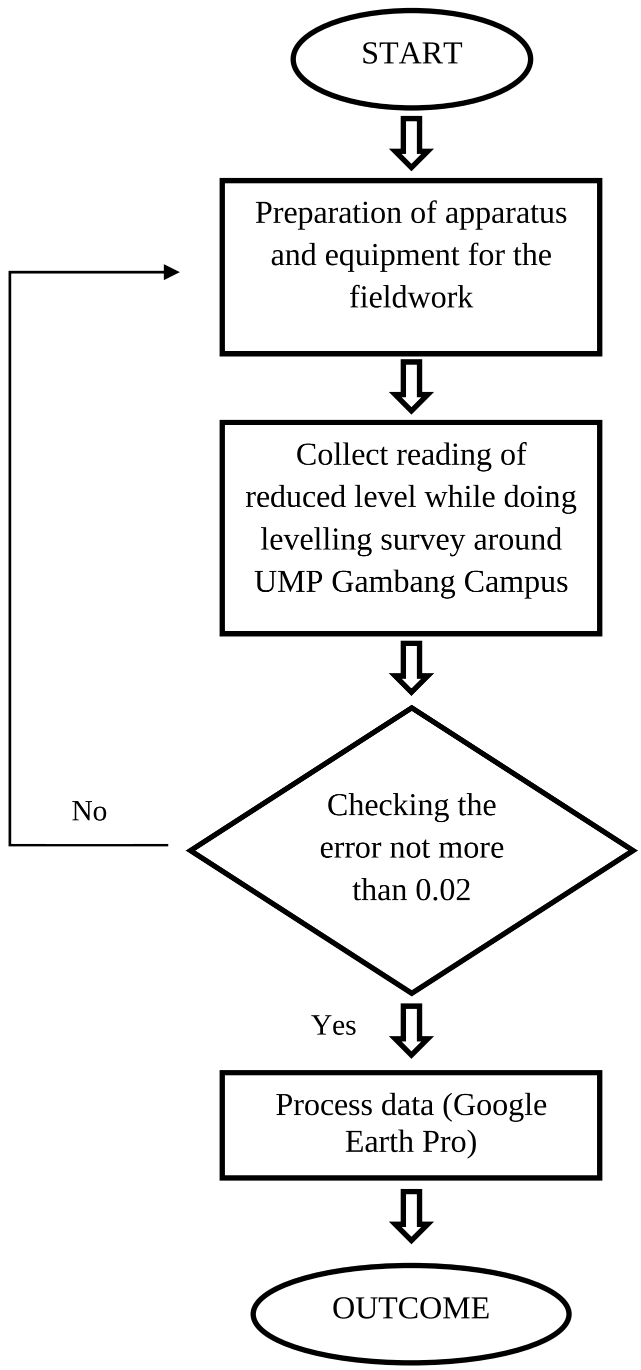

Figure 3.1 General Flow Chart for processing result

This methodology is used to get results based on the established study objective and is based on a general flow chart. The planning must be constructed to accommodate any future issues.

The equipment needs to be set up on the study area first. The staff reading must stand vertically on the TBM point while the auto level is first constructed and placed alongside. The reading must begin with the TBM point, which is in front of the lab, and continue around the UMP Gambang Campus while turning around and returning to the TBM.

The data must then be entered into the fieldwork sheet's table to calculate the UMP Gambang Campus's reduced level. The data obtained from the fieldwork are shown in Table 3.1 below. The formula must be used to check the fieldwork's mistake in order to verify the accuracy of the data obtained. The error cannot exceed 0.02.

$$(\text{Last Reduced Level} - \text{First Reduced Level})$$

$$(\sum \text{BS} - \sum \text{FS})$$

$$(\sum \text{RISE} - \sum \text{FALL})$$

The reduced level data must next be processed in AutoCAD in order to be seen in an image and used to create a cross-horizontal profile.

Table 3.1 Levelling Data

BS	IS	FS	RISE	FALL	REDUCED FALL	REMARKS
1.54					49.224	TBM 1
	-2.214		3.754		52.978	BRIDGE
1.475		1.35		-3.564	49.414	TABLE
1.455		1.375	0.1		49.514	AIRCOND
1.305		1.39	0.065		49.579	ELECTRIC BOX
1.483		1.866		-0.561	49.018	DRAINAGE LAB
1.71		1.27	0.213		49.231	STREETLIGHT ETIM
1.64		1.345	0.365		49.596	STREETLIGHT CHEMIST LAB
	1.255		0.385		49.981	SIGNBOARD LAB
1.48		1.78		-0.525	49.456	TREE
1.55		1.455	0.025		49.481	TREE
1.67		1.377	0.173		49.654	BUNCH
1.39		1.39	0.28		49.934	MOSQUE INTERSECTION
1.59		1.767		-0.377	49.557	MOSQUE FENGE
1.45		1.462	0.128		49.685	NET BALL KK1
1.489		1.84		-0.39	49.295	FENGE KK1
	1.48		0.009		49.304	GATE KK1
1.374		1.525		-0.045	49.259	CAFE
	1.505			-0.131	49.128	ZINK FENGE KK3
0.752		1.525		-0.02	49.108	STREETLIGHT KK3
	1.469			-0.717	48.391	PIPE COART
1.65		1.507		-0.038	48.353	SIGNBOARD
	1.372		0.278		48.631	INDAH WATER 1
1.455		1.437		-0.065	48.566	INDAH WATER HOLE 2
	1.515			-0.06	48.506	WALKWAY OFFICE KK3
1.42		1.541		-0.026	48.48	PMPP
1.511		1.664		-0.244	48.236	BACK FENGE KK3
1.406		1.52		-0.009	48.227	INTERSECTION JPHA
1.264		2.719		-1.313	46.914	STREET MIRROR RUMAH TAMU
	1.65			-0.386	46.528	GARAGE
1.364		1.79		-0.14	46.388	PAVILLION BUNCH
1.521		1.505		-0.141	46.247	BUNCH KOR SUKSIS
	1.517		0.004		46.251	BACK KOR SUKSIS
1.518		1.6		-0.083	46.168	INSTITUTE SAINS MATH
	1.417		0.101		46.269	PARKING DEKAN FIST

1.666		1.329	0.088		46.357	POKOK
0.045		2.13		-0.464	45.893	BLOCK X, Y
1.481		1.5		-1.455	44.438	XBK 02
1.482		1.535		-0.054	44.384	XDK 06
1.58		1.685		-0.203	44.181	BLOCK X
1.504		1.565	0.015		44.196	BLOCK Y
1.491		1.431	0.073		44.269	WATER TANK BLOCK Y
1.497		1.535		-0.044	44.225	PILI BOMBA BLOK M
1.54		1.476	0.021		44.246	SELEKOH BLOK Z BELAKANG
1.381		1.464	0.076		44.322	SELEKOH BLOK Z DEPAN
1.5		1.485		-0.104	44.218	FIRE HIDRANT BLOK Z
1.18		1.432	0.068		44.286	FENCH Z-Y-Z
1.385		1.64		-0.46	43.826	TRESS BESIDE BXYZ
1.16		1.421		-0.036	43.79	DRAIN LAB
	1.574			-0.414	43.376	WATER PIPE
1.174		1.639		-0.065	43.311	ELECTRIC POLE
1.285		1.59		-0.416	42.895	ELECTRIC POLE
1.551		1.63		-0.345	42.55	GATE JUNCTION
1.368		0.975	0.576		43.126	INTERSECTION UMP
1.205		1.793		-0.425	42.701	MAIN GATE UMP
1.993		1.001	0.204		42.905	TREE
1.906		0.946	1.047		43.952	SIGNBOARD UMP (HIJAU)
	1.193		0.713		44.665	YELLOW FENCE HITAM
2.05		0.77	0.423		45.088	ENTRANCE
2.265		1.026	1.024		46.112	EXIT
2.652		0.966	1.299		47.411	ENTRANCE LIBRARY
1.419		0.701	1.951		49.362	PARKING
2.59		1.532		-0.113	49.249	PERKING DEKAN FKASA
1.503		0.46	2.13		51.379	RESERVE PARKING UMPA
1.465		1.44	0.063		51.442	PARKING FIM
1.222		1.409	0.056		51.498	STREETLIGHT FIM
1.466		1.535		-0.313	51.185	BESIDE LAB (BLACK GATE)
1.576		1.482		-0.016	51.169	BUNVH SIGNBOARD
1.431		1.48	0.096		51.265	TO 4 AHU 1 ROOM
1.393		2.338		-0.907	50.358	SIGNBOARD STOP
1.465		1.322	0.071		50.429	WATER TANK
1.442		1.416	0.049		50.478	STREETLIGHT
0.16		1.476		-0.034	50.444	STREETLIGHT INFRONT ETIM

1.831		1.786		-1.626	48.818	INTERSECTION TO LAB SURVEY
1.412		1.235	0.596		49.414	CONTENA
1.433		1.465		-0.053	49.361	STREETLIGHT
-2.141		-2.143	3.576		52.937	BRIDGE
		1.536		-3.677	49.26	TBM 1
92.47		92.434	20.095	-20.059		

Table 3.2 Checking for Error

	BS-FS	RISE-FALL	RD2-RD1
ERROR	0.036	0.036	0.036

The position of the data grab was indicated by the mark in Google Earth Pro to get the latitude, longitude, and altitude data of each location in UMP Gambang Campus. Figure 3.2 show the location that we get the data. After that. The file must to save in Kmz format and convert it to Microsoft Excel to get the latitude, longitude, and altitude data. To show the topographic mapping, QuikGrid software can show with enter the Microsoft Excel data. Open the file at the left corner of the interface and click Input scattered data point and click input metric data point. After that choose Microsoft Excel file and then open. Figure 3.3 show procedure on how to extract the file.

Figure 3.2 UMP Gambang Campus Map

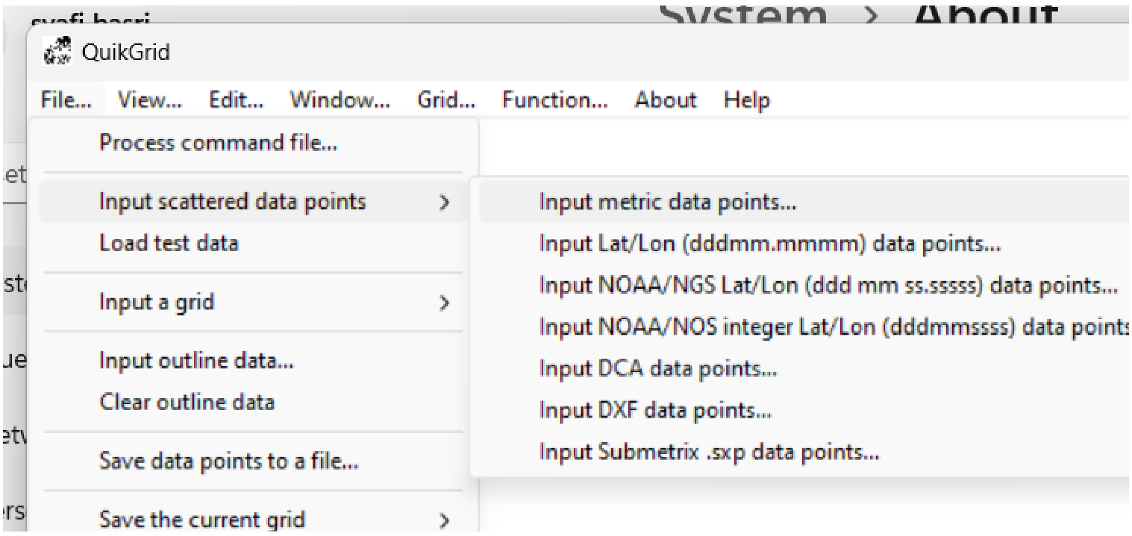

Figure 3.3 Input Data to QuikGrid

3.3 Land Survey Flow Chart

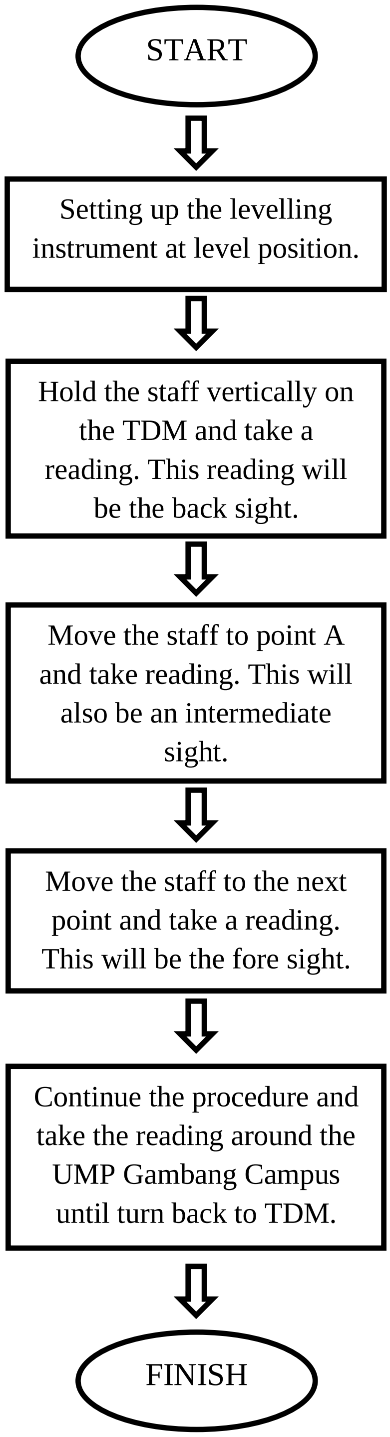

Figure 3.4 Land Survey Flow Chart

3.3.1 Setting Up

The distance between the backsight and foresight should be same to avoid any inaccuracies caused by collimation, refraction, or earth curvature. The distances between objects should not be so great that it is difficult to see the graduations. However, they must not be lower than the staff's height. The observation locations must be below the instrument's level.

3.3.2 Elimination of Parallax

Parallax is the term for the apparent movement of the image brought on by the observer's eye moving at the eyepiece. It may be eliminated by pointing the telescope at infinity and then adjusting it until the crosshairs are sharply in focus. The situation won't alter in the mind of a certain observer. The apparent movement of the picture caused by the observer's eye moving at the eyepiece is known as parallax. By aiming the telescope at infinity and then adjusting the eyepiece until the crosshairs are clearly in focus, it may be removed. For a certain observer's eye, the scene won't change.

3.3.3 Booking

In a register, level books and loose-leaf levelling sheets must be given a number and index. You must provide information on the location, the job, the date, the observer, the booker, the weather, the wind, the instrument, and any other pertinent details. Fill out the Backsight field with the initial observation (which is on a known point) and the Remarks column with enough information to identify it. Enter the R.L. zero for the point from the site registration, the BM plate. All other points on successive lines, save the one selected as the foresight, should be entered as intermediates. The Remarks column should be used to identify them. Enter the foresight in the "Foresight" column on a separate line. The instrument should be set up as shown below. Write the following backsight in the Backsight column on the same line as the previous foresight. Repeat the technique at each setup on the outward run, then on the return, do the opposite to get back to the start. The same procedures are used to the closest point as to all other change points.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

For this chapter, the result that we obtained from methodology approach and interpreted the data based on levelling method. The data was processed using software that can access the data such as Google Earth Pro and QuikGrid that can show the result in graphical. The topography variation of the UMP Gambang Campus is significant and interesting to observe.

4.2 Cross Horizontal Profile for UMP Gambang Campus

Relief refers to the scientific measurement of a landscape's vertical elevation variation. It is the difference between the highest and lowest heights within a certain area, which is often of very small extent. Qualitative terms like "low relief" or "high relief" might be used to categories reliefs. The definition of the scale over which it is measured is significant since the relief of a landscape might change depending on the size of the region over which it is observed.

Since AutoCAD is used to generate illustrations that highlight the elevation differences for each area based on data from the field study, the data collected from the fieldwork has been entered into AutoCAD to show UMP Gambang Campus cross horizontal profile. The results obtained from land survey approach was the most accurately compared with other method because the equipment was setting on site area and the equipment produce data from the structure of land. The fundamental aim is to improve our ability to identify the topographic variation in the study area.

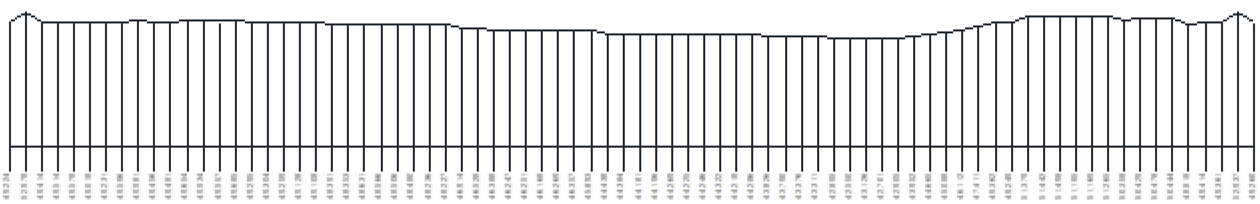

Figure 4.1 Cross Horizontal Profile for UMP

From this result, the first objective of this study which is to determine the elevation of the topography variant's terrain relief at UMP Gambang Campus have obtained. Based on figure 4.1, it is shown the cross horizontal profile for UMP Gambang Campus using levelling method. As shown, UMP Gambang Campus mostly have flat surface and less slope area of elevation. The slopy area just minimum because the safety factors and for sustainable building. The higher elevation in UMP Gambang Campus was obtained is 52.937m and the lowest elevation that obtained is 42.550m from datum.

A benchmark's height is determined in relation to the heights of neighboring benchmarks along a network that extends from a basic benchmark. Typically mean sea level, a location with a clearly known connection to the vertical datum of the world may function as a fundamental benchmark. Large-scale maps display the location and height of each benchmark.

4.3 Terrain Mapping for UMP Gambang Campus

Knowing the topography helps to save soil, especially in developing areas. Contour ploughing, which is the process of ploughing along lines of similar height rather than up and down a slope, is an established technique that enables sustainable development on sloping terrain. The term "terrain" is used in development with a very broad definition that includes not only landform but also land use, land cover, surface transport facilities, constructions, physical geography, but also, economic factors under the term "human terrain." Weather patterns are greatly influenced by the terrain. Because of changes in elevation or a "rain shadow" effect, two sites that are geographically adjacent to one another may have drastically different precipitation levels or timing.

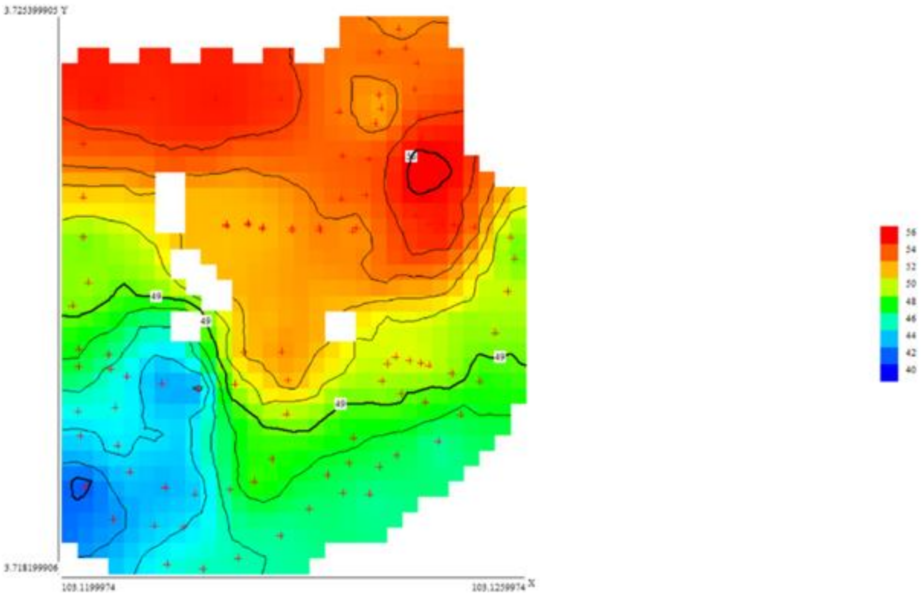

Figure 4.2 2D Terrain Map of UMP Gambang Campus

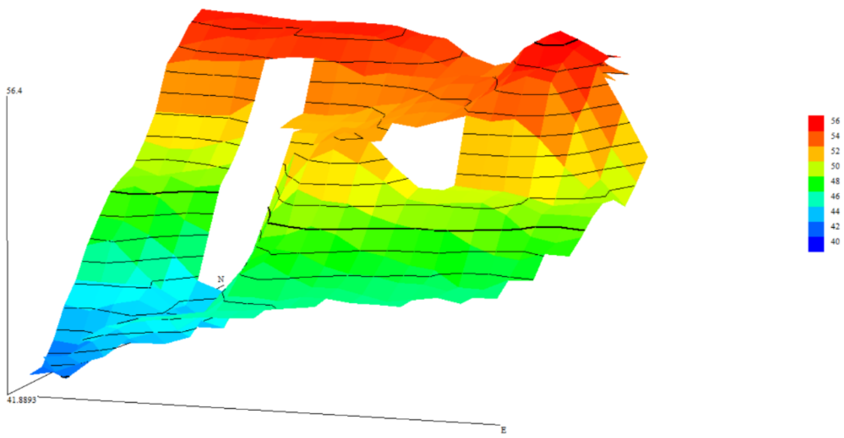

Figure 4.3 3D Terrain Map of UMP Gambang Campus

Figure 4.2 represents a 2D topography map of the UMP Gambang Campus, while Figure 4.3 represents a 3D version. The position of the data grab is indicated by the mark in figure 4.2. Software can show the outcome in graphical images in both 2D and 3D mapping from that data. In both figures, the lowest area is shown by the blue location, which is followed by the green and yellow colours. Campus' gateway is shown by the blue region, and blocks W, the library, and KK3 buildings are indicated by the green and yellow areas. For orange and red colours, the UMP Gambang Campus's chemical lab area has a greater degree of elevation. From this result, the objective was achieved which is to provide the current topography mapping accurately.

CHAPTER 5

CONCLUSION

5.1 Introduction

This chapter a brief review about the studies that has been conducted for almost 14 weeks. The final outputs of the study have been determined in the previous Chapter 4. In this chapter, conclusion was stated as the overall summary for the study that highlighted that the objectives have been achieved. Recommendations are offered as possible ways to improve this study.

5.2 Conclusion

The study achieved all the objective stated in the beginning of thesis. The first objective was to determine the elevation of the topography variant's terrain relief at UMP Gambang Campus have achieve when the cross horizontal profile was made in chapter 4. Reduced Level is the major outcome that must be discovered. In surveying, the term "reduced level" refers to equal survey point elevations with respect to a commonly accepted datum. Between the survey point and the chosen datum plane, there is a vertical distance. As a result, it is regarded as the baseline elevation that is used to estimate the heights or depths of other significant locations. In this context, the terms "reduced" and "level" refer to equating. Datum is a place, actual or imagined, having a nominal height of zero.

The second objective also achieved when the terrain map in 2D and 3D was made in previous chapter. These results show the significant place in UMP Gambang Campus has low elevation and more place has high elevation. Understanding the terrain assists in preserving soil, especially while building. An established method for allowing sustainable construction on sloped soil is contour ploughing. Ploughing along lines of equal height rather than up and down a hill is what is meant by this method.

5.3 Recommendations of study

The analysis for development facilities and natural sustainability includes a review of topographic variation. Although the land survey approach requires a lot of time and effort, it has a high degree of accuracy. There are a few improvements that may be suggested for the apparatus used for this, one of which is to improve the apparatus's capacity for reading data at a distance by including accessories like zooming. While retaining accuracy, this can save surveyors time and effort. accuracy, one of the key components of surveying, may help with project management at the planning stage of construction.

Another recommendation is to take the reading at many locations around study area included at bushes and in forest area. This will increase the accuracy of data getting. Therefore, the current topographic map will more accurate and easier to identify the location with elevation.

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APPENDICES

Appendix A: Levelling Survey Fieldwork

The pictures above show the levelling survey data collection while doing fieldwork. This fieldwork takes three weeks to finish data collection around UMP Gambang Campus. The apparatus used in this study was borrow from UMP Survey lab. The apparatus use is tripod, auto level and staff reading.